UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VIII
999 18th STREET - SUITE 500
DENVER, COLORADO 80202-2405

JAN 31 1991

Ref: 8HWM-FF

Mr. Frazer Lockhart
Department of Energy/Rocky Flats Plant
Trailer 130A
P.O. Box 928
Golden, CO 80402

Dear Mr. Lockhart:

In accordance with the terms of the Interagency Agreement (IAG), enclosed please find the Environmental Protection Agency's (EPA) comments on the draft Past Remedy Report for Operable Unit 3 (enclosure 1). Comments from the Colorado Department of Health (CDH) are also enclosed (enclosure 2).

In general, the draft document will require a number of modifications in order to be an acceptable final document. These include the following major items which are reflected in the enclosed specific comments:

1. A complete site conceptual model must be developed which shows consideration of the source of contamination in the settlement lands, the appropriate release mechanisms, the appropriate transport and receiving media, and all potential exposure pathways.

2. At many points in the document, statements and assumptions are made with no reference or justification presented in the text. This results in a document which lacks credibility. The final Past Remedy Report should be edited carefully to ensure that the rationale for important assumptions is presented and appropriate references cited.

3. The conclusion that the available data are not of sufficient quality to be used in a quantitative risk assessment is the basis for all the statements regarding risk that are made in the document yet is unjustified by the information presented. For this reason, it is imperative that a complete evaluation of the available data be included in the final Past Remedy Report. This evaluation should follow the criteria contained in the EPA publication "Guidance for Data Useability in Risk Assessment". Only after such an evaluation can conclusions be drawn about the quality of the data.

4. Regardless of the data useability for quantitative risk assessment, the final document must include some type of quantitative indicator of relative risk of the contamination in the settlement lands before, during, and after the remedy. EPA

suggests an evaluation of soil contamination of 1, 10, and 100 pCi/gm using the methodology contained in section C of the Health Effects Assessment Summary Tables.

Most of these general items have been discussed at length during the review and comment period. A final Past Remedy Report which has been modified in accordance with the enclosed comments will be a useful document from which to begin designing an adequate remedial investigation. Should your require any additional discussion or clarification of these comments, please contact Ms. Bonita Lavelle at (303)294-1165.

Sincerely,

Martin Hestmark

Martin Hestmark, Rocky Flats Team Leader
Federal Facilities Remedial Branch

cc: Gary Baughman, CDH
Robert Birk, DOE
Michael Guillamme, EG&G
Peter Ornstein, 8ORC
Bonnie Lavelle, 8HWM-FF
Tom Greengard, EG&G
Barbara Barry, CDH-RFPU

Page F-1, paragraph 2: The draft Interagency Agreement (IAG) does not incorporate the terms of the Settlement Agreement of July 1985.

Page F-1, paragraph 4: Although the Department of Energy (DOE) makes the statement in the Past Remedy Report that the available data are not of sufficient quality to support a rigorous quantification of human health risks, there is no documentation to support this. The final report must include as an appendix, the studies which are referenced in the text along with a detailed evaluation of the data using criteria contained in the EPA publication "Guidance for Data Useability in Risk Assessment" (EPA/540/G-90/008).

Page ES-2, paragraph 4: Include the existing data which indicates "...that there has not been any measurable exposure to human receptors downwind of SWMU 199...". In general, qualitative statements such as "measurable exposure " must be supported with the data and a discussion so that the reader can follow the logic on which such claims are based.

Page ES-2, paragraph 2: Include a reference for the statement that the great majority of soil plutonium concentration originated as windborne particulates from the 903 pad. The fires which occurred at the Rocky Flats Plant in 1957 and 1969 resulted in releases of contaminants which conceivably could have been transported to off site media. The discussion of site history should include this information.

Page 1, paragraph 2: Site number 199 is not limited to the areas which were the subject of the 1975 lawsuit but includes all lands containing contamination from the Rocky Flats Plant.

Page 1, Paragraph 2: The 1975 lawsuit referred to in this paragraph was actually the landowners against the United States, not DOE. This is referred to correctly in other parts of the document but needs to be corrected in this instance.

Page 1, paragraph 3: Site 198 has been deleted from the draft IAG. The last two sentences in this paragraph should be deleted to reflect this.

Page 2, Section 1.1: The specific objective listed in this section as "Provide a preliminary qualitative health risk assessment..." is not consistent with the requirements of the IAG. Table 5 of the Statement of Work (SOW) requires that DOE include a health risk assessment in this report. Section VII.D of the SOW details the components of a health risk assessment. A "preliminary, qualitative " assessment does not fulfill the requirements of Section VII.D. of the SOW. The objective should be to provide a quantitative health risk assessment. Although it is recognized that this objective could not be met due to

problems with the quality of the available data, the intended objective must be consistent with the terms of the IAG. As this section is currently written, it appears predecisional and biased against quantitative assessment.

Page 3, paragraph 1: The draft IAG does not require consistency with the National Environmental Policy Act (NEPA). Like the NEPA regulations, the remedial investigation/feasibility study and remedy selection processes under CERCLA provide for consideration of the potential impacts of CERCLA response actions on the environment and for significant public participation. CERCLA response actions are not required to follow procedures in addition to those in the NCP in order to comply with NEPA.

Page 3, paragraph 2: Provide a reference for the EPA screening level of 20 pCi/g. Presumably, DOE is referring to material contained in EPA publication 520/1-90-016, Transuranium Elements, Volume 2. It is important that the reader understand the assumptions and methodology used to determine the EPA screening level and the EPA action level.

The Colorado Department of Health (CDH) soil guideline/standard of 0.9 pCi of plutonium per gram of soil is more restrictive than the EPA screening level guidance of 0.2 x $10^6$ pCi of transuranic radionuclides per square meter of soil surface area for samples collected at the surface to a depth of 1 cm and for particle sizes under 2 mm. However, the difference is not as large as that stated in the report. Depending on the assumed specific gravity of the soil, the EPA screening level guidance corresponds to a calculated total transuranic concentration in the range of 8 to 20 pCi/gram of soil. Other differences between the CDH and EPA guidelines are the depths of the sample layers (the CDH guideline considers the top 1/8" of soil while the EPA guideline considers 1 cm) and soil particle size. Any comparison of the two guidelines must contain this information.

Page 4, section 2.1, Location and Physical Description: The last sentence in this section indicates that public access to lands within OU-3 is restricted. This seems to be inconsistent with the description on page 12, section 2.2.1 which states that 250 acres were dedicated to the Jefferson County Open Space program. What kinds of land use restrictions, if any, are associated with the Open Space Program? Please clarify as this has impact on the types of populations exposed before, during, and after the remedy was implemented and also the types of activities those populations are likely to be engaged in. Recognize also that an assessment of the risks after the remedy has been implemented must include consideration of future land use. Paragraph 6.2.2 of the Risk Assessment Guidance for Superfund, Volume I contains guidance on the consideration of future land uses. Specifically this guidance recommends that a risk assessment assume future residential land use if it seems possible based on the evaluation

of the available information in various land use planning documents for the area. EPA believes this land use scenario is possible.

Page 4, Section 2.1.1, Historical Contamination from the RFP: This section should include some mention of other sources of off site soil contamination such as accidental releases.

Page 4, Last Paragraph: Background concentrations of plutonium and americium are referred to here and in a number of other places in the Past Remedy Report, but are not defined. A definition of background should be included (particularly since these radionuclides are not naturally occurring at this site). A table of background concentrations should be provided for comparison with the site historical data. A reference and a description of the background data collection location should also be provided. Background levels of uranium should be considered also.

A quantitative basis for evaluating site contamination is needed. The background concentrations referred to are anthropogenic rather than naturally-occurring; therefore, a specific definition of the term as it is used here will avoid the unintended misinterpretation that plutonium and americium are naturally-occurring compounds at SWMU 199 (see EPA, 1989, Section 5.7.1).

Page 8, Section 2.1.2.2, Surface Water: Walnut Creek does not discharge into Standley Lake, Woman Creek discharges into Standley Lake.

Page 9, Section 2.1.2.3, Groundwater: The large discrepancy between the estimates of horizontal flow velocity for the Rocky Flats Alluvium needs to be addressed. What is the uncertainty associated with each estimate? What are the plans for additional investigations for determining the horizontal velocity? Future investigations can be mentioned in section 4.14, Data Needs.

page 11, Section 2.1.2.5, Biota: The section on biota is inadequate. Biota needs to be addressed in terms of the adverse effects on the ecosystem as a result of soil contamination and not merely "as it pertains to contaminant fate and transport and to remedial activities". Please refer to the Risk Assessment Guidance for Superfund, Volume II, Environmental Evaluation Manual (EPA 540-1-89-001). The draft past Remedy Report does not mention important foodwebs in the area of Operable Unit 3 (OU-3) and there is no discussion within other sections of the report on the possible effects on ecological systems of plutonium and americium concentrations in the soils. The report only mentions vegetation and one species, prairie dogs. The Environmental Evaluation Manual recommends that an environmental evaluation consider the following factors which influence the effects of contaminants on ecological systems:

1. Susceptibility of existing species
2. Characteristics governing population abundance and distribution
3. Temporal variability in communities
4. Movement of chemicals in food chains

Provide a detailed and accurate description of the existing ecological system, and an acceptable environmental evaluation.

Pages 11 and 12, Section 2.1.2.5.: Only two of the species listed as common to the area (western wheatgrass and sideoats grama) are contained in the revegetation seed mix listed. The use of a more compatible seed mix would enhance revegetation success. Native species will be more successful in establishing a permanent vegetative cover than nonnative species and will require less manipulation of the environment.

Page 13, second paragraph: What was the thickness of the top layer of soil represented by the soil sample collection procedure used during the 1977 to 1979 field investigation program? That is, was the CDH procedure employed? If not, how did the collection procedure differ from the CDH procedure?

Page 14, second paragraph: At a minimum, provide a reference document for the results of the soil sampling completed during 1977. A table summarizing the results would be more useful along with an appendix containing all the referenced studies.

Page 14, third paragraph: Same comment as above. The results of the 1985 soil sampling program at least need to be referenced and it would be best if the data were summarized in the body of the report and contained in an appendix.

Pages 17 through 20, Section 2.2.3.1: As required by the settlement agreement, grass seed was planted in Section 7 during the fall of 1986 but was plowed up in June and July of 1987 because the seeding effort was deemed a failure. As a result, the reseeding program was revised. This revision is not appropriate because the initial reseeding program was abandoned prematurely. The original plan should be implemented. Because these grasses typically emerge late, the abandonment schedule did not allow time for emergence and development. Sections 7 and 18 were then seeded in April, which is the wrong season for planting these grasses. The evaluation of success of the seeding effort was premature, therefore some of the proposed actions on page 19 are unnecessary. Reseeding without tilling, preferably with a change of seed mixture (to a completely native mix), are appropriate. The other actions listed are unnecessary and counterproductive (Wolfe, 1982).

Page 19, third paragraph: Before the treated water from holding pond C-2 is used for irrigation of remedial acreage as suggested

in this paragraph, an assessment should be done of the resulting concentrations of plutonium, americium, uranium, and other contaminants which will be transported downstream through surface runoff. How can the cities consider using pond water from C-2 which may then eventually drain into Standley Lake or Great Western Reservoir when they are currently designing a diversion canal and holding pond to "physically separate Rocky Flats Plant from the water supplies" for the cities of Broomfield and Westminster? This appears to be inconsistent and puts into question the purpose of the water diversion project.

Page 21, first paragraph: Figure 3-1 appears to be inconsistent with the language in section 3.0 of the report. It is more accurate to label the Rocky Flats Plant as the historical contamination source and surface water and air as the historical transport media. Suggested revisions to figure 3-1 were provided to DOE and EG&G at a meeting on January 10, 1991.

One important secondary transport medium which has been neglected in section 3.0 and figure 3-1 is soil. Contaminants can be transported internally by ingestion and externally by dermal contact with the soil. These two important exposure pathways need to be considered.

Page 21, first paragraph: It would perhaps be more useful to present this information in both a diagrammatic and tabular form. First, consider all possible release mechanisms, transport media, receiving media, and exposure routes. As information is gathered about the physical/chemical properties, some of the media and exposure routes may be eliminated or information which needs to be gathered can readily be identified. However, by showing diagrammatically and in tabular form, it will be obvious that all were considered and you will be better able to justify conclusions made about risks.

Page 22, fourth paragraph: What is the basis for the conclusion that "plutonium is the only significant contaminant at SWMU 199"? The decision to consider only plutonium in OU-3 may or may not comply with guidance contained in EPA's Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual and the NCP. The technical justification for not looking at other contaminants must be presented in this report. Where no technical justification exists, the contaminant must be considered. In particular, americium, a decay product of plutonium, needs to be considered.

Page 23, Section 3.1, Source Area Characteristics: The assumption is made here and throughout the report that the plutonium present in the off site soils is plutonium dioxide, but no rationale or data to support this assumption are provided nor are any references cited. Data should be provided that verify this assumption or a rationale to justify it should be presented. The form of plutonium in the environment is an important factor

to be considered when evaluating transport and exposure pathways. Justification of the assumption that plutonium exists as plutonium dioxide is essential in order to validate the health risk evaluation.

Page 25, Section 3.3, Fate and Mobility in Surface Water: Colloidal transport of plutonium in ground water is briefly mentioned but is not followed by any discussion of the colloidal transportation of plutonium by surface and ground waters. Additionally, the recommendations and conclusions do not address this possibility by suggesting further study of it. Some further discussion of this phenomenon is required, if only to dismiss it as a reasonable possibility based on site conditions, data, or other rationale. Colloidal transport of plutonium and americium far beyond distances previously expected has been shown to occur (Penrose, 1990). It is important to explain how colloidal transport is related to SWMU 199 site contamination. This explanation should demonstrate that all potential transport pathways have been evaluated. Colloidal transport is recognized in other DOE documents as a potential transport mechanism. It is discussed in the Surface Water Interim Remedial Action Plan.

Page 26, Section 3.4.: This section should include a statement that the fate, transport, and qualitative health risk associated with plutonium in surface water and reservoir sediments have been evaluated and discussed (DOE, 1990b). Such a statement will provide assurance that the potential transport and exposure pathways associated with surface water run-off from SWMU 199 are being fully evaluated. Without such a statement, the discussion of the plutonium fate in the reservoirs appears overly simplistic and out of place.

Page 27, Section 4.0, Qualitative Human Health Risk Assessment: This section should restate that a quantitative risk assessment will be performed in accordance with the EPA guidance (EPA, 1989) as part of the remedial investigation. This statement is important because the evaluation conducted is inadequate with respect to EPA guidance. It would also assure that this document serves only as a preliminary assessment for directing further studies.

Page 27, first paragraph: The objectives of this report as stated in this paragraph completely ignore the environmental component of the risk assessment. Protectiveness to both human health and the environment must be assessed as part of the risk assessment process.

Page 27, second paragraph: What is the basis for the conclusion that "the quantity and quality of existing data for SWMU 199 are insufficient to perform a rigorous quantitative human health risk assessment for the site"? In order to determine the validity of this statement, the data must be presented and analyzed. A

assessment for the site"? In order to determine the validity of this statement, the data must be presented and analyzed. A qualitative assessment without adequate justification is unacceptable in that it does not comply with the requirements of the IAG, the NCP, or EPA guidance on conducting risk assessments for Superfund sites. This section should include a tabular presentation that demonstrates the historical data's inadequacy for a quantitative assessment. For example, the table should list the various studies and show the differing or unknown analytical methods, the differing or questionable detection limits, the differing analytical laboratories, and the lack of quality assurance procedures where it is relevant. Criteria for such an evaluation is contained in the EPA publication "Guidance for Data Useability in Risk Assessment" (EPA/540/G-90/008). Such a systematic tabulation of the data's inadequacies will provide the basis for the justification of a qualitative as opposed to quantitative assessment.

Page 27, third paragraph: Define the term "contaminant of concern". Is this a subset of all the contaminants thought to be present at the site? What is the basis for not looking at all contaminants? This paragraph seems to be contradictory. The statement is made that plutonium is the "only contaminant of concern" however, an additional statement that "media specific analyses of other radionuclides present at the RFP, such as americium-241, have not be performed ..." How can a determination be made that plutonium is the only contaminant of concern when no others have been considered? Are there any non-radioactive contaminants of concern?

Page 28, first paragraph: If available information indicates that the added risk due to the presence of americium is more than one order of magnitude as stated in this paragraph, then americium must be considered. If the statement in this paragraph is in error, then it should be corrected; otherwise, the conclusions are in error.

Page 30, Section 4.2, ARARs: This section on ARARs should be introduced with some statements explaining how ARARs are considered along with information from a risk assessment in establishing remediation goals during the feasibility study process. Refer to section 300.430(e) of the NCP for guidance on the establishment of remediation goals. Without such an introduction, this section on ARARs appears extraneous to the remainder of the draft Past Remedy Report and the relationship between ARARs and acceptable exposure levels determined in the risk assessment process is not clear. Another alternative is to delete this section from the report entirely as the objective of the report is merely to provide a risk assessment. If the section is retained, the ARARs should be organized in a table to which references can be made as needed. This will help to address the document's organizational problems.

Page 30, Section 4.2, ARARs: The air monitoring data mentioned briefly in this section should be summarized in a table (average plus or minus one standard deviation, maximum, and minimum for some representative time period) and moved to the section on historical data. There should also be a discussion of how well the data represent a reasonable estimate of air emissions from SWMU 199. These data are mentioned but not used in the evaluation, consequently, the reason the data are not used and the way they compare quantitatively with the standards should be mentioned. Because the air pathway is considered of primary importance, a more complete discussion of these data is important to the evaluation. Also, the reason these data are not useful for a quantitative assessment is not clear. This is very important for directing the remedial investigation because direct measurements of the air emissions from SWMU 199 are very useful when evaluating the site's risk.

pages 30-31: The toxicity assessment is completely inadequate. There is no mention of the basic indicators of toxicity such as the weight of evidence, the cancer potency slope factors, reference doses, or discussions on what studies these factors are based on. This information is available in the Health Effects Assessment Summary Tables published quarterly by EPA and should be included in the toxicity assessment. Also, Section 7.7 on page 7-20 of the Risk Assessment Guidance for Superfund, Volume I, contains explicit guidance on summarization and presentation of toxicity information in a risk assessment.

Page 31: The statement on page 31 that the levels of plutonium in soils are "very low" is qualitative and has no basis without quantitative comparisons (i.e., low compared to what?). As the text is written, there is no information presented which allows for such a conclusion.

Page 31, Last Paragraph: The statement that "the low levels of internal exposure that workers and the public could potentially receive from SWMU 199...can cause genetic and somatic...effects..." is unsupported by a reference or an explanation. Also, the "low levels" referred to are undefined because no doses are calculated. This discussion should be rewritten with evidence and references included.

page 32, last paragraph: The identification of exposure pathways is impossible without an assessment of the exposed population. The exposed population must be identified and characterized in terms of the predominant population and the sensitive subpopulations. Land use scenarios must be fully developed. Section 4.12 should be moved to precede the discussion of exposure pathways. Identification of the characteristics of the exposed population is the first step in any exposure assessment. Refer to the Risk Assessment Guidance for superfund, Section 6.1.1 for additional guidance.

page 32, last paragraph: Other site characteristics that need to be considered include meteorology and location and description of surface water.

page 33, second paragraph, section 4.5.1: Bioaccumulation needs to be considered in an environmental evaluation as a potential secondary release mechanism.

page 33, section 4.5.2, Identification of Transport Media: The basis for the conclusion that the only primary transport media for plutonium is surface soils must be provided. Were any other transport media investigated or is this conclusion based on an incomplete investigation of all possible transport media? Also in this section, it appears that the terms transport media and release mechanism are being misused. For example, groundwater is correctly referred to as a transport media but surface runoff and biotic uptake which are release mechanisms are incorrectly referred to as transport media also. The transport media for these mechanisms are surface water and biota respectively.

page 36, second paragraph: The basis for the statement that the potential impact of re-entrained soil particles on human receptors appears low seems to be the results of air sampling. This data must be presented and discussed in this report in order to justify qualitative statements such as this.

page 36, section 4.5.2.2, Plutonium uptake in the Food Chain: This section references section 3.1.3. There is no section 3.1.3. Provide a reference which supports the conclusion that plutonium is not considered to be ecologically mobile.

page 36, section 4.5.2.2, second paragraph: Provide a reference for and the value of Log $K_{OW}$ for plutonium and discuss what this value indicates in terms of potential for bioaccumulation. What is a "low" value for this parameter? Such qualitative statements must be supported by quantitative values.

Page 36, Section 4.5.2.2: The statements made in the first three paragraphs regarding the low solubility and low mobility of plutonium in the physical and biological environment should be referenced. These statements are central to the analysis of potential transport and exposure pathways and, therefore, require justification by reference to published scientific data.

Page 36, Section 4.5.2.2, Last Paragraph: The first two sentences, which are a generic description of aquatic nutrient cycling, appear unrelated to the last statement regarding the $K_{O}w$ of plutonium and uptake of plutonium by terrestrial plants. The information on aquatic nutrient cycling appears irrelevant to the discussion and the site. The purpose of this discussion should be clarified or eliminated. The statement regarding the low $K_{O}w$

of plutonium should be moved to the paragraph where this parameter and its relationship to food chain transfer are discussed.

Page 37 and 38, Section 4.5.2.2: The paragraphs concerning foliar deposition of radionuclides appear unnecessary and should be eliminated. There is no discussion of relationship between the factors presented and conditions at SWMU 199. Section 4.5.3.4 dismisses biotic uptake as a concern without any mention of foliar deposition and makes the unreferenced statement that "...indicator plants and animals have been identified, sampled, and found to contain normal background ranges of plutonium...." Consequently, it is not clear what the discussion of foliar deposition is meant to contribute to the analysis.

The statement regarding the results of sampling and analysis of plants should be expanded and referenced (and a brief, tabulated summary of these results included in the historical data section). It would be more appropriate to add to Section 4.5.3.4 a short paragraph stating that foliar deposition can occur and may lead to contaminant transfer up the food chain but that data indicate this is not occurring.

When background information is presented, it should be linked to site conditions and processes. If data indicate a particular pathway is unimportant, then the data should be discussed and referenced to justify elimination of that pathway. Evidence that the pathway was considered and justifiably eliminated is necessary.

Page 38, Section 4.5.2.3. This section should be rewritten so that it agrees with Section 3.4 which indicates that some migration of plutonium from SWMU 199 to the adjacent reservoirs may be occurring as a result of erosion processes.

Page 39, section 4.5.3, Potential Exposure Pathways at SWMU 199: Figure 4-1 ignores the soil ingestion pathway. This pathway may be significant and should be considered.

Page 39, second paragraph: Based on the discussions contained in previous sections of the report, an additional probability ranking of "not enough data available to make a determination" appears to be necessary. Since the discussion on transport media recognizes that plutonium can be deposited on plants and subsequently be available for ingestion by humans or animals, that surface runoff can cause plutonium to migrate, and that groundwater quality data are required to conclusively determine that SWMU 199 is not impacting groundwater, these three media should be ranked accordingly. The data required to make an assessment of these three media should then be identified in section 4.14, Data Needs.

Page 40, last paragraph: All ingestion pathways are discounted relative to inhalation purely on the basis of low GI absorption.

This is a serious error. In many instances encountered in Region VIII, intake via ingestion has exceeded intake via inhalation by up to several orders of magnitude. In fact, it appears from recent monitoring data at the Rocky Flats Plant that ingestion vs inhalation intake ratios may be on the order of 10,000:1 to 100,000 :1, using standard exposure assumptions and assuming that all airborne activity is associated with respirable particles. Once particle size/radioactivity associations are known, these ratios may go even higher. Certainly, this difference in intake rates could potentially offset the difference in absorbed doses estimated between ingestion and inhalation exposures. Without quantitative data on relative intake, it is not possible to estimate relative risks due to these exposure routes, even on a qualitative basis. It is certainly possible that ingestion of contaminated soil could pose a significant risk relative to dust inhalation in the off site areas.

Page 41, Section 4.5.3.2, Surface Runoff Media: The text in this section is irrelevant to the pathways shown at the end of the section and should be completely removed. The discussion need only point out that plutonium may migrate in surface water to nearby reservoirs as stated previously and the various pathways that may result are evaluated in the assessment of SWMUs 200 through 202 (DOE, 1990b). The discussion of airborne plutonium dusts is inappropriate in a section on surface water pathways.

Page 44, Section 4.6.1: The discussion of plutonium's biological half life is confusing. It is unclear what the values presented in parentheses mean. This discussion should be clarified.

Page 45, Section 4.6.2: Provide a reference and rationale for the assumption that Class Y plutonium is the class found at SWMU 199.

Page 48, Section 4.7.3: Present or reference data to support the statement that the chemical form of plutonium at SWMU 199 is insoluble.

Page 48, Section 4.7.3.: Because no dose equivalent has been calculated, it is inappropriate to state that the dose equivalent is negligible. Data should be tabulated and presented as discussed so they can be compared with the unit risks presented (with the appropriate caveats concerning data quality). Major assumptions should be justified with references and a clear rationale. If this is done, a conclusion that the risk associated with SWMU 199 contamination is most likely low to negligible would be better supported.

Page 52, Section 4.13: The statement that, "Toxicological data errors are probably the largest source of uncertainty..." implies that the data are incorrect and should be reworded. The author

probably means that extrapolating the data to different species and doses is highly uncertain.

Page 53, Section 4.14: Nowhere in the data needs section is the need for representative air emissions data for SWMU 199 mentioned. This should be included. Inhalation of fugitive dusts from the site is considered the most important exposure pathway; therefore, direct measurement of airborne dusts and any associated plutonium and americium contamination is an obvious data need for the quantitative risk assessment.

## References


DOE, 1990a. U. S. Department of Energy, "Final Draft: Remedy Report, Operable Unit 3 - SWMU 199," U.S. Department of Energy, Rocky Flats Plant, Environmental Restoration Program, Golden, Colorado, October 24, 1990.

DOE, 1990b. U. S. Department of Energy, "Final Draft: Historical Information Summary and Preliminary Health Risk Assessment Operable Unit 3 Sites 200, 201, & 202," U.S. Department of Energy, Rocky Flats Plant, Environmental Restoration Program, Golden, Colorado, November 5, 1990.

EPA, 1989. U. S. Environmental Protection Agency, "Risk Assessment Guidance for Superfund, Volume I Human Health Evaluation Manual (Part A), Interim Final," U.S. Environmental Protection Agency/540/1-89/002, December 1989.

Grandt, A., 1977, Species Trials on Strip Mined Areas. In J. L. Thames (ed.), Reclamation and Use of Disturbed Land in the Southwest University of Arizona Press, Tucson, AZ.

Penrose, W., W. Polzer, E. Essington, D. Nelson, and K. Orlandini, 1990. "Mobility of Plutonium and Americium through a Shallow Aquifer in a Semiarid Region," Envir. Sci. Technol., Vol. 24, pp. 228-234, 1990.

Wolfe, M. H. 1982, Establishment of Native Grasses in the Southern Rocky Mountains. Proceedings of the Symposium of Reclamation of Mined Lands in the Southwest, Albuquerque, NM, October 20-22, 1982.